Autonomous Agents and Multiagent Systems
2007/2008

Lab 4

Multiagent Society: Social Tolerance Model

1   Objectives

- Introduction to the concept of multiagent societies and emergent social behavior.

- Implement a social tolerance model and explore its behavior.

2   Social Tolerance Model

This social tolerance model was based on Tomas Schelling's social tolerance model. Thomas Schelling was a pioneer in agent based modeling research to study the behavior of multiagent societies.

The model simulates the emergence of segregation phenomena in heterogeneous societies based on the concept of tolerance to difference among individuals.

To simulate the model, a grid with 81 cells (9 by 9), which can be occupied by individuals from two different classes, was defined. Each cell contains at most one individual. Initially, individuals are randomly placed in the grid.

During the simulation, individuals may move to a non-occupied adjacent cell. The decision to move is based on whether he is happy in its current position. If this is the case, he doesn't move, otherwise, he moves.
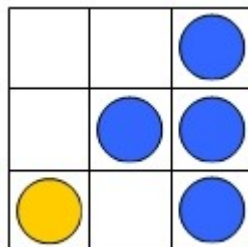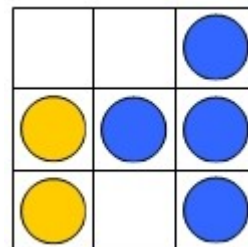
Happy   Not happy

Figure 1 – Considering that the individual in the center has a tolerance factor of a quarter, on the left he is happy, while on the right he is not happy with its current position.

To determine whether the individual is happy with its current position, it is necessary to count the neighbors and check whether the percentage of neighbors from the opposing class is higher or lower to its tolerance. If it's superior, the individual is not happy and will move. Otherwise, the individual is happy and will not move. For instance, considering in Figure 1 that the individual in the center has a tolerance factor of a quarter, he will be happy whenever there are three neighbors of its class per neighbor of the opposing class.

3   References

Schelling's publication describing this model:

SCHELLING, Thomas C. 1978. *Micromotives and macrobehavior*. New York: Norton. (pp. 147-154).

Robert Axelrod's page describing this exercise:

http://pscs.physics.lsa.umich.edu/Software/CC/CCAB/EXERCISES/EX-1/EXERCISE.1.html

4   Exercise

- Implement the social tolerance model in NetLogo from the base file.

- Study the society behavior, varying the tolerance factor and population count variables.

  Try to correlate the effect of each variable (tolerance and population count) with the population dispersion in space and with the ease with which an equilibrium, where everybody is happy, is reached.

  Precisely, test the following conditions:

  a) The populations have the same count and different tolerance values

  b) The populations have the same tolerance but different count

  Try to answer the following questions:

- Populations with lower tolerance disperse more or less than populations with higher tolerance?

- Is it easier to reach equilibrium, with everybody happy, when the populations are more or less tolerant?

- Do minorities occupy space in a more compact fashion than majorities?

- Is it easier to reach equilibrium, with everybody happy, when the number of elements of each population differs?

  Support your conclusions with statistical data. Define a set of test cases and register the data as in the table below.

Test run	1	2	3	4	5	6	7	8	9	10
Dispersion P1	low	low	low	middle	high	low	low	low	low	middle
Dispersion P2	high	high	high	middle	low	high	high	middle	high	middle
Step count	200	156	*	*	345	123	222	145	789	452

Table 1- Test results for the case where both populations have 20 elements and tolerance factors are, respectively, 60% and 30%. Note: The * (star) in the field 'Step count' means no equilibrium was reached.